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Dynamic framerate adjustment

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ABSTRACT

Presentation of content from a computer or other device on a large screen, such as a projector or a television, is a common activity. The computer is connected to the large screen via a wired or a wireless connection. The content to be presented can include documents and presentation slides with static content such as text and graphics, or content that includes motion such as videos. Default encoders that target high frame rates do not account for content type. The content of a document or slide may appear blurry or include undesirable artifacts if presented at a high frame rate. If the default encoder is configured with a low frame rate, videos may appear jerky and unpleasant to view.

This disclosure describes techniques to select an appropriate content presentation mode that targets a suitable frame rate. The selection is based on encoder statistics, e.g., the percentage of blocks that change in successive frames of the video content from the computer. The selected mode uses a suitable framerate based on the type of content for display on the large screen.

KEYWORDS

- auxiliary display
- framerate adjustment
- content presentation
- dynamic encoder

BACKGROUND

Personal computing devices such as laptop computers, smartphones, tablets, etc. enable users to present slides, documents, video content, etc. on a large screen, such as a projector or television. Such presentation of content is common, e.g., during meetings, talks, presentations, etc. Video data from the personal computing device is sent for display to the large screen via a wired connection (e.g., VGA, HDMI, DVI, etc.), or via a wireless network. Content can include static content, e.g., content with no or low motion, such as presentation slides and documents. Content can also include standalone videos, e.g., online videos, video files, etc. or videos embedded within a presentation. Video content includes motion, e.g., pixel values that change between successive frames.

The video content is encoded, e.g., by a default encoder. A default encoder that targets higher frame rates can cause static content of a document or slide to appear blurry and include artifacts when displayed on a large screen. Alternatively, an encoder that targets lower frame rates can result dynamic content such as videos appear jerky and unpleasant to look at.

DESCRIPTION

This disclosure provides techniques to select an appropriate mode to display static and dynamic content during a presentation from a personal device on a large screen. The mode corresponds to a framerate that is appropriate for the content. Specifically, the techniques select a display mode based on encoder statistics, such as changes in the number of blocks from one frame to the next within the content.

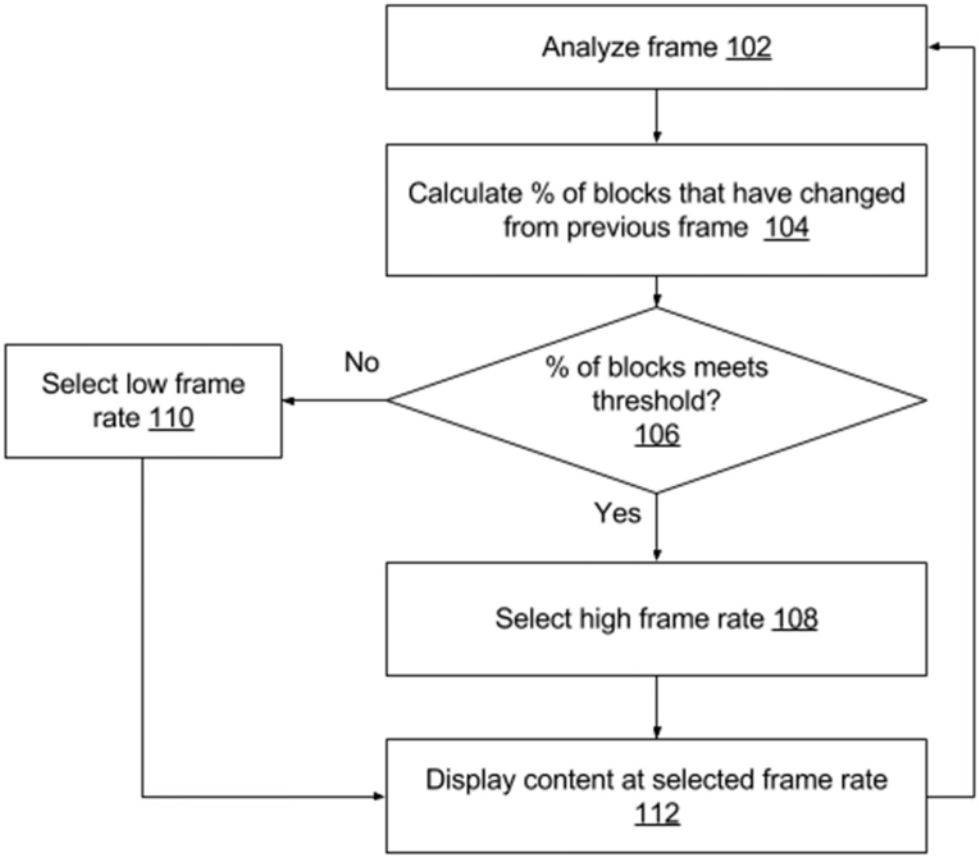

Fig. 1: Dynamic frame rate adjustment

Fig. 1 illustrates the technique to display content with dynamic frame rate adjustment. A content frame is analyzed (102). The percentage of blocks in the frame that have changed from the previous frame are determined (104). Blocks refers to segments of the frame (e.g., pixel blocks) that are compared with corresponding segments of the previous frame.

If the percentage of blocks that changed from the previous frame meets a threshold, e.g., when the change between successive frames is significant such as when the content includes video, a high frame rate is selected (108). If the percentage of blocks that changed from the previous frame does not meet the threshold, e.g., when the change between successive frames is not significant, such as when displaying static content, a low frame rate is selected (110). The

content is displayed on the large screen at the selected frame rate (112). For example, a high frame rate may be 25 or 30 frames per second or higher, allowing for proper display of video content, and a low frame rate may be 5 frames per second. The counts of I-frames, B-frames, and P-frames can trigger the change of frame rate.

For example, when static content such as a document, or a photograph is being presented, the frame rate may be set low. While such presentation, if there are some parts of the content that include motion, e.g., due to presence of items such as animated GIFs, due to movement of a mouse pointer, due to a system-generated animation (e.g., a "spinner" that indicates that the computer is working) etc., a change may be detected between successive frames. However, since this change is for a relatively small percentage of blocks, the frame rate is not changed.

Continuing with the example, when the presentation includes content with motion, e.g., a full-screen video, or a video embedded in a presentation slide, a relatively large percentage of blocks may change between successive frames. In this case, since the change is for a relatively high percentage of blocks (e.g., based on size of the video relative to overall size of the display, amount of motion in the video, etc.), the frame rate is changed to high. When the video ends and the presentation reverts to static content, the frame rate is automatically adjusted to low.

The process of Fig. 1 is periodically repeated to select the appropriate presentation mode frame rate based on content. The process to determine the frame rate can also be performed at specific times, e.g., when a slide presentation switches from one slide to the next. A user is provided with options to manually override the presentation mode, and if the user permits, such override information is used as user feedback to improve dynamic selection of frame rates.

The techniques described in this disclosure can be implemented in software and/or hardware. For example, a computer that is used to conduct video conferences and connects to an

auxiliary display wirelessly can implement the techniques to provide a display of the video conference on the auxiliary display. The computer can be a general-purpose computer that is connected to the auxiliary display, or a special-purpose computer that is deployed specifically for video conferences.

In situations in which certain implementations discussed herein may collect or use personal information about users (e.g., user data, information about a user's social network, user's location and time at the location, user's biometric information, user's activities and demographic information), users are provided with one or more opportunities to control whether information is collected, whether the personal information is stored, whether the personal information is used, and how the information is collected about the user, stored and used. That is, the systems and methods discussed herein collect, store and/or use user personal information specifically upon receiving explicit authorization from the relevant users to do so. For example, a user is provided with control over whether programs or features collect user information about that particular user or other users relevant to the program or feature. Each user for which personal information is to be collected is presented with one or more options to allow control over the information collection relevant to that user, to provide permission or authorization as to whether the information is collected and as to which portions of the information are to be collected. For example, users can be provided with one or more such control options over a communication network. In addition, certain data may be treated in one or more ways before it is stored or used so that personally identifiable information is removed. As one example, a user's identity may be treated so that no personally identifiable information can be determined. As another example, a user's geographic location may be generalized to a larger region so that the user's particular location cannot be determined.

CONCLUSION

This disclosure describes techniques to dynamically select a mode for displaying content from a computer onto a larger screen based on encoder statistics such as changes in number of blocks from frame to frame. By selecting one mode to display text (at lower frame rates) and a different mode to display video (at higher frame rates), both text and video are presented at the appropriate frame rates. This results in video display in a smooth and non-jerky manner and text display without blurring and undesirable artifacts. Therefore, slide presentations with embedded video and text are displayed seamlessly by making more educated guesses with respect to the type of content being presented by the user and switching modes to ensure smooth display.